

U.S. Patent Application Serial No. 10/073,877
Amendment dated November 21, 2003
Reply to OA of August 22, 2003

REMARKS

Claims 2-5, 7-10, 12 and 15-26 are pending in this application. Claims 1, 6, 11, 13, and 14, have been canceled without prejudice and rewritten as new claims 22-26, to more clearly set forth the present invention.

New claim 22 has been written to require forming the second III-V compound layer directly on, and disposed above, the first III-V compound layer. The remaining original claims have been amended to correct claim dependency and to conform to new claims 22-26.

Support for new claims 22-26, and the original claims as amended, appears throughout the specification, drawings, and claims as originally filed. No new matter has been added.

The Examiner is thanked for indicating claims 3-12, 14-16, and 18, allowable if rewritten in independent form.

In view of the new claims, claims as amended and remarks set forth below, favorable consideration is respectfully requested.

- I. At page 2, paragraph 4, of the Office Action, claims 1-2, 13, 17, and 19-21, have been rejected under 35 USC § 130 (a) as being unpatentable over Otsuka (US 5,568,501) in view of Fujihara (US 5,227,015).*

The Examiner states that it would have been obvious to the skilled artisan to recognize that the etchant disclosed by **Otsuka** would contain hydrochloric acid, acetic acid, and water as taught by **Fujihara** because this etchant is conventional. The Examiner further states that the modification

would provide a semiconductor laser with high reliability in which current leakage is reduced (**Fujihara** col. 5, lines 34-40, and the Abstract).

Fig. 3 of **Otsuka** corresponds to the method of producing the laser of Fig. 1A. Fig. 3A of **Otsuka** illustrates an InP substrate, having a waveguide InGaAsP layer provided thereon, an active layer provided on the waveguide layer, a p-InP cladding layer provided on the active layer, a p-InGaAsP cap layer provided on the cladding layer, and a mask layer of silicon nitride provided on the cap layer. See col. 9, lines 20-47.

Thereafter, an "acetic acid type" etchant is used to preferentially etch the p-InGaAsP cap layer. The upper face of the substrate is then etched using a chloric acid type etchant, to form the mesa structure. See col. 9, lines 48-60.

At that point, an undoped InP layer 5, and the first (p-InP) and second (n-InP) current blocking layers 6 and 7, are grown. The silicon nitride mask layer is removed, and the cap layer is removed. The third blocking layer 8, a barrier reducing layer 9, and a contact layer 10, are then grown. Electrode layers 11 and 12 are then vapor deposited to form the structure. See the paragraph bridging cols. 9 and 10.

Present claim 1 has been rewritten as new claim 22, and requires a stacked structure having a first III-V layer containing In which is not InP (layer 104) and a second III-V layer containing In (layer 104A) formed directly on said first III-V layer and disposed above said first III-V layer.

The Examiner appears to take the position that layer 2 (waveguide layer InGaAsP) of **Otsuka** is equivalent to the present first III-V compound semiconductor layer containing In, and that **Otsuka's** cap layer (InGaAsP) or perhaps cladding layer (InP) is equivalent to the present second III-V compound layer. We note that these two layers of Otsuka are not in physical contact.

New claim 22 requires that the first and second III-V layers be in physical contact.

The Examiner appears to contend that **Otsuka** discloses forming a stepped structure of InP. The present figures and specification define a stepped structure of InP, as including the raised parts 106a and 106b. See present Fig. 11C, 13C, etc. The embodiment illustrated in **Otsuka's** Fig. 3 does not include a stepped InP structure.

In **Otsuka's** Fig. 3, the current blocking InP layers are formed while the mask layer 15, which substantially overhangs the mesa, and the cap layer 14, are in place. Thus, a "stepped structure of InP" is not formed. Rather, **Otsuka's** resultant structure is planer and includes the mask layer.

Otsuka discloses at cols.13 and 14, corresponding to Fig. 12, that current blocking InP layers 5-7 are grown with layer 15 in place. Layer 15 in this embodiment does not substantially overhang the mesa. Please see Fig. 12C. After layer 7 is formed, the mask layer 15 is removed and layers 8-10 are grown on InP layers 5-7. Layer 8 is an p-InP layer but it is not "stepped" and is not wet etched. Layer 9 is a pGaInAsP layer that is grown directly on layer 8. **Otsuka does not teach wet etching the InP structure** (layer 7) as is clear from Fig. 12C and the disclosure at cols. 13 and 14.

Present claim 22 requires that the stepped structure of the composite structure be wet-etched with an etchant including hydrochloric acid and acetic acid. The method of **Otsuka** described at cols. 13 and 14, does not teach wet-etching InP layers 5-7, let alone etching with an acetic acid type etchant.

Regarding **Fujihara**, **Fujihara** teaches dry etching a stacked structure followed by wet etching using the etchant hydrochloric acid, oxygenated water and acetic acid in a volume ratio of 3:1:36. The wet etchant serves to etch the InP buffer layer 102, thereby forming the mesa structure. Thereafter, current blocking layers 108 and 109 are formed. Burying layer 110 and contact layer 111, are then successively formed on current blocking layer 109. **Fujihara** does not teach or suggest forming the presently required first and second layers, forming a stepped InP structure, nor wet etching a stepped InP structure, as presently required.

Otsuka does not teach or suggest a structure including a first III-V compound semiconductor layer containing In and having a composition different from InP and a second III-V compound semiconductor layer containing In, where the second III-V compound layer is formed directly on, and is disposed above, the first III-V compound layer, as required by present claim 22.

Further, **Otsuka** does not teach or suggest wet etching a stepped structure, let alone wet etching a stepped structure with the required etchant of present claim 22. Again, Fig. 12 of **Otsuka**, discussed at cols. 13-14, discloses forming a structure of InP. However, only the silicon nitride mask layer is removed from this structure. The InP layers are not wet etched as is clear from Fig. 12C.

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In conclusion, **Otsuka** does not teach or suggest: forming the required first and second III-V compound layers; wet etching a stepped structure of InP; and does not suggest the present etchant.

Fujihara does not cure the deficiencies of **Otsuka**, because **Fujihara** also does not teach or suggest the present required layers, forming a stepped structure, and does not suggest wet etching a stepped structure, as presently required.

In view of the new claims, claims as amended and remarks set forth above, it is submitted that nothing in **Otsuka** or **Fujihara**, taken alone or together, render the claimed invention obvious within the meaning of 35 USC § 103. Accordingly, the Examiner is respectfully requested to withdraw this rejection.

In view of the aforementioned amendments and accompanying remarks, claims 1-26, as amended, are in condition for allowance, which action, at an early date, is requested.

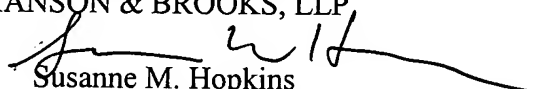
If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact Applicants undersigned attorney at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

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In the event that this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper, to Deposit Account No. 01-2340.

Respectfully submitted,

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